REMARKS

Claims 6-32 and 40-57 are pending in this application. Claims 9-13 are withdrawn from consideration. By this Amendment, claims 6-32 and 40-57 are amended. No new matter is added. Reconsideration of the application is respectfully requested.

I. Claim Objection

The Office Action objects to claim 14 because of informalities. Specifically, the Office Action indicates that claim 14 recites a second lens/cylindrical lens, but the base claim 40 does not include a first lens/cylindrical lens. Claim 14 recites additional features of the optical means recited in claim 40. Although Applicants do not believe that correction is required, claim 14 is amended to delete the term "second" only for the purpose of clarification. Therefore, claim 14 is not narrowed by such amendments. Accordingly, withdrawal of the objection is respectfully requested.

Claims 6-32 and 40-57 are also amended only to correct informalities, and thus are not narrowed by such amendments.

II. Rejections Under 35 U.S.C. §102(e) and §103(a)

The Office Action rejects claims 40-42, 6, 7 and 14-16 under 35 U.S.C. §102(e) over U.S. Patent No. 6,212,216 to Pillai ("Pillai"); rejects claim 8 under 35 U.S.C. §102(a) over Pillai in view of U.S. Patent No. 3,866,141 to Milam et al. ("Milam"); rejects claims 17-28, 43-48, 55 and 56 under 35 U.S.C. §103(a) over Pillai in view of U.S. Patent No. 6,393,035 to Weingarten et al. ("Weingarten"); rejects claims 49, 51 and 52 under 35 U.S.C. §103(a) over Pillai in view of Weingarten, and further in view of U.S. Patent No. 6,347,109 to Beach et al. ("Beach"); rejects claims 53, 54 and 57 under 35 U.S.C. §103(a) over Pillai in view of Weingarten, and further in view of Applicants' admitted prior art; rejects claims 29-32 under 35 U.S.C. §103(a) over Pillai in view of Beach; and rejects claims 30 and 31 under 35 U.S.C.

§103(a) over Pillai in view of Beach, and further in view of Applicants' admitted prior art. Applicants respectfully traverse the rejections.

Pillai does not disclose, teach or suggest a laser means including "optical means for producing a pump beam by imaging each single emitter into a same spot, wherein said optical means further includes an upstream optical means to collimate said particle beam in a vertical plane, and a downstream optical means to collimate said particle beam in a horizontal plane," as recited in independent claim 40, and similarly recited in independent claims 41 and 42.

Further, Pillai does not disclose, teach or suggest a diode-pumped laser including a laser means that includes an "optical means for imaging a pump light beam into a substantially asymmetrical spot with a smooth intensity profile," as recited in independent claim 43.

Pillai teaches external cavity micro laser devices that are coupled into an optical fiber or an optical waveguide to produce a spot of a minimal diameter and a round cross section. See at least col. 1, lines 5-8 and col. 6, line 55 - col. 7, line 24.

Pillai teaches that high ellipticity or high aspect ratio of an output beam cross-section makes single mode fiber coupling inefficient due to poor matching with modes of the optical fibers that are symmetrical. See col. 1, lines 53-63. To reduce this problem, Pillai teaches how to get a round and symmetric spot beam out of high asymmetric beams. Pillai does not teach any pump device or asymmetric pump beam that can be used to pump a solid state laser media. In contrast, the laser means and laser of claims 40-43 maintain or enhance an asymmetric cross-section of an initial emission to pump a solid state laser medium with a high elliptical laser mode.

Because Pillai teaches forming a round and symmetric beam, the physical properties of the optical system of Pillai is different from the optical means of the laser means and laser of claims 40-43. For example, as shown in Figs. 9 and 10, Pillai teaches that a laser light

propagates from left to right and is collimated by an amorphic lens 77 in a fast axis direction. See col. 7, lines 6-8. Because the beam is already parallel in the slow axis direction, a lens 79 is a pure focusing lens that produces a focused spot that is the same size as a symmetric waveguide spot size. See col. 7, lines 9-11. As a result, the system performs only one single collimation with subsequent focusing in both axes.

Similarly, in Figs. 20 and 21, Pillai teaches that a beam from an emitter 164 is collimated in one direction by a lens 158. Subsequently, the beam, which is already parallel in the other direction due to initial emission characteristics, is focused by a lens 160.

The optical systems of claims 40-43 use two optical means that collimate beams in orthogonal directions. Because the beams are still divergent in a second direction after the first collimation, a parallel beam is achieved in a first orthogonal direction. The divergent beams that enter the second collimating means at a distance from the optical axis are collimated in the second direction and directed toward the common spot, so that the beam becomes parallel in the second direction. This arrangement achieves the desired high aspect ratio that is required to produce an extended spot in one dimension.

In pump setups, such as the setups disclosed in Pillai, deviation of the pump spot may be produced if some emitters of a pump diode array die or degrade. As a result, distribution of light within the pump spot may be altered. To reduce these problems, the laser means and laser of claims 41-43 use a scheme where both a pump mode and a lasing mode have strong asymmetries. See page 2, lines 9-10 of the specification. Therefore, the cross-section of a pump beam spot is relevant in such a scheme because the pump beam spot cross-section has to match with an ideal mode cross-section. Any deviation from the ideal cross-section of the desired lasing mode may increase the contributions of other, less desirable modes to the overall laser generation. Therefore, the desired result is a substantially smooth, i.e., structureless, asymmetric laser diode pump spot with a homogenous illumination and a cross-

section adapted to that of the lasing mode. See Fig. 2a, and page 2, lines 10-13 of the specification.

For example, as shown in Figs. 8a-8d of the present specification, a pump spot is obtained from a laser diode array source 1a, 1b or multiple stacked arrays 1c, by imaging each single emitter of the array or the arrays into substantially the same spot at a laser medium 14. Therefore, the spot is not a result of single spots placed side by side, like in Pillai. Instead, the spot is a combination of multiple projections of individual spots, each illuminating an identical common spot area. As a result, if one emitter dies or degrades, the overall intensity may be slightly decreased, but the spot may still be homogenous and without an internal structure.

To transfer the emission of the single emitters of the array 1a, 1b, 1c into the common spot with a high aspect ratio, two optical means are used to collimate a beam in two orthogonal directions/axes, respectively. Additionally, the laser means may also use one of the optical means to focus the beam, as set forth in claim 40.

For example, as shown in Fig. 8a of the present specification, the optical means may include a first cylindrical lens 15 and a first lens 16. The first cylindrical lens 15 may collimate strongly divergent light of the laser diodes in one axis. Subsequently, the light may be collimated by the first lens 16 in the other orthogonal axis and concurrently directed to the common spot, as set forth in claim 41. The direction of the pump light to the common spot is a result of the divergence of the pump light in the other orthogonal axis and a distance of an axis from the emitter to optical axis of the first lens.

Fig. 8a also discloses that the first lens 16 has the ability to focus the beam in the one axis. This additional focusing effect may be used when the spot size in the vertical direction is not small enough. As a result, the beam is narrowed again by the focusing effect.

However, a first lens with focusing functionality is not required, as set forth in claim 42. See Fig. 8d.

Because Pillai does not teach or suggest the features of a pump beam by imaging single emitters in a same spot, optical means collinating in both vertical and horizontal planes, and imaging the pump beam into a substantially asymmetrical spot, Pillai does not teach or suggest the laser means or laser of claims 40-43. Milam, Weingarten, Beach and Applicants' admitted prior art do not remedy the deficiencies of Pillai.

Milam teaches a wedged window 28 in a laser system 10. See Figs. 1 and 2. Weingarten teaches a laser crystal 2 that receives laser light 10. See Figs. 1, 2 and 7. Beach teaches a thin disk laser system including a beam splitter 12 that splits pump radiation 10 to include an output beam 19, and a laser resonator 14, 16, 18, 20 and 22. See Fig. 2. Applicants' admitted prior art teaches using glue for bonding. However, neither Milam, Weingarten, Beach nor Applicants' admitted prior art teaches or suggests imaging each single emitter into a same spot, collimating a beam in different planes, and imaging the beam onto a substantially asymmetrical spot, as set forth in independent claims 40-43, respectively. Therefore, neither Milam, Weingarten, Beach nor Applicant's admitted prior art alone or in combination, teaches or suggests the laser means and the diode-pump laser of claims 40-43.

Therefore, claims 40-43 would not have been rendered obvious by Pillai in view of Milam, Weingarten, Beach nor Applicants' admitted prior art. Claims 6-32 and 44-57 depend from claims 40, 42 and 43, and thus also would not have been rendered obvious by Pillai in view of Milam, Weingarten, Beach or Applicants' admitted prior art. Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 6-32 and 40-57 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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Date: June 14, 2005

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